

CONNECTOR LOCK STRUCTURE

BACKGROUND OF THE INVENTION

5 This invention generally relates to a connector lock structure, and more particularly to a connector lock structure having a mechanism for releasing a locked condition of connector housings.

 Hitherto, there has been a lock structure shown in Figs. 5 and 6 (see, for example, JP-A-2000-150069), which serves as a structure for connecting
10 male and female connector housings to each other, for locking this connected condition, and for releasing this locked condition.

 The lock structure shown in Figs. 5 and 6 is configured so that a lock portion 1 having a lock arm 3 and a releasing arm 5 is formed integrally with the female connector housing.

15 As shown in Fig. 6, the lock arm 3 includes two curved leg portions 3a formed in such a way as to upwardly protrude and extend from an outer wall 7, two arm portions 3b respectively and horizontally extending from the two leg portions 3a along a connector fitting direction toward a latch portion of a counterpart connector, and an engaging portion 3c which is formed in such a
20 manner as to connect ends of the two arm portions 3b to each other and has a locking claw 3d.

 As shown in Fig. 6, the releasing arm 5 includes two leg portions 5a and two arm portions 5b. The two leg portions 5a upwardly protrudes and extends from the outer wall 7 and are thinner than the leg portions 3a. The
25 two arm portions 5b is respectively formed on the two leg portions 5a. Each

of the two leg portions 5a is formed at an outer side of an associated one of the leg portions 3a and at nearly the same position as that of the associated leg portion 3a.

5 The arm portions 5b are formed so that end parts thereof extend in a direction opposite to the engaging portion 3c and are connected to each other to thereby form the releasing portion 5c, and that the other end parts thereof extend toward and are connected to the engaging portion 3c.

10 In a case of releasing the locked condition of the lock portion 1, the releasing portion 5c is depressed in the direction of an arrow A as shown in Fig. 6. The releasing arm 5 turns in response to a force exerted on the releasing portion 5c so as to surely upwardly and pivotally move the engaging portion 3c in the direction of an arrow B around each of the leg portions 5a. As a result, the locking claw 3d is disengaged from the latch portion of the counterpart connector (not shown) to release the locked condition.

15 Because the releasing arm 5 has the leg portions 5a, the engaging portion 3c surely displaces in a lock releasing direction B in response to a force applied to the releasing portion 5c regardless of a direction and an angle of application of the force. Consequently, cancellability of the structure is enhanced.

20 However, in the case of the lock structure of the related lock portion 1, when the engaging portion 3c is engaged with and disengaged from the latch portion of the counterpart connector, the lock arm 3 and the releasing arm 5 swing around the leg portions 3a and 5a protruding upwardly from the outer wall 7 of the connector housing, respectively.

25 Thus, bending stresses are apt to be concentrated at bent portions k1

at each of which an associated one of the leg portions 3a intersects with an associated one of the arm portions 3b, bent portions k2 at each of which an associated one of the leg portions 5a intersects with an associated one of the arm portions 5b, and corner portions k3 and k4 at which the leg portions 3a and 5a continued to the outer wall 7 of the connector housing, respectively.

Fatigue due to stress concentration in the leg portions 3a and 5a may result in permanent deflections thereof and may cause reduction in an engaging strength of the engaging portion 3c, or fatigue destruction thereof.

In the lock structure of the related lock portion 1, a position, at which the engaging portion 3c of the lock arm 3 is equipped, is away from the outer wall 7 of the connector housing by a height h of each of the leg portions 3a. Thus, the lock structure of the related lock portion 1 has a problem in that the size of the connector housing increase owing to increase in the dimension of the outside diameter of the connector housing, which is caused by outward protrusion of the engaging portion 3c.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a connector lock structure enabled to maintain a stable engaging strength over a long time and also enabled to prevent increase in the outside dimension thereof in size.

In order to achieve the above object, according to the present invention, there is provided a connector lock structure, comprising:

a first connector housing;

a second connector housing, which is fitted to the first connector housing;

5 a flexible lock member, which is frontwardly extended from the first connector housing along a connector fitting direction, and which has an engagement portion provided at an end portion thereof;

a latch member, which is provided on the second connector housing, and which is engaged with the engagement portion;

10 an operating arm, which upwardly protrudes from the end portion of the lock member and rearwardly extends, and which has a operation portion provided at a rear end portion thereof; and

a fulcrum projection, which is provided on at least one of an outer wall face of the lock member and a bottom surface of the operating arm facing the outer wall face.

15 Preferably, the flexible lock member is formed by a part of an outer wall of the first connector housing. The fulcrum projection is provided on at least one of an outer wall face of the first connector housing and the bottom surface of the operating arm facing the outer wall face of the first connector housing.

20 Preferably, when the operating portion is depressed, the operating arm pivotally swing around the fulcrum projection as a fulcrum so as to deform the end portion of the lock member upwardly so that an engagement between the latch member and the engagement portion is released.

25 Preferably, a presser portion is provided on at least one of the lock member and the operating arm. A preventing member is provided on an outer face of the first connector housing, and engages with the presser portion

so as to prevent the lock member from lifting.

In the above configurations, in a case where the locked condition of the engaging portion provided at an end portion of the flexible lock member and the latch member of the second connector housing is canceled, when the operation portion provided at the rear end portion of the operating arm is depressed, the operating arm pivotally swing around the fulcrum projection placed on the bottom thereof, so that the end of the operating arm upwardly moves.

Then, when the end of the operating arm upwardly moves, an upward force acts upon an end portion of the flexible lock member to which the end portions of the operating arm are connected. Thus, the end portion of the flexible lock member is upwardly bending-deformed. Consequently, the engaging portion provided at the end portion of the flexible lock member disengages from the latch member of the second connector housing.

That is, when the engagement between the engaging portion and the latch member of the second connector housing is canceled, the operating arm pivotally swing around the fulcrum projection. Moreover, when the engaging portion engages with and disengages from the latch member of the second connector housing, the entire flexible lock piece is bending-deformed like a cantilever, an end of which is a free end. Thus, there are no leg portions similar to those, at which stress concentration is apt to occur, in the related lock structure.

Thus, the lock member according to the invention can prevent occurrences of permanent deflection resulted from fatigue due to stress concentration. Consequently, the lock structure can obtain excellent durability

that enables the connector to maintain a stable engaging strength over a long time.

Further, the flexible lock member is frontwardly extended from the front end of the step-like part of the upper wall of the first connector housing along the connector fitting direction. Thus, the lock structure does not need leg portions that upwardly protrude from the outer wall surface of the first connector housing. Consequently, the connector can be designed so that the position, at which the engaging portion of the flexible lock member is provided, can be adjusted to the position of the upper wall of the first connector housing.

Thus, the lock structure can suppress the flexible lock member and the operating arm from protruding upwardly from the outer wall surface of the first connector housing. Consequently, the lock structure according to the invention can prevent the outside dimension of the first connector housing from increasing owing to the protrusion of the flexible lock member and the operating arm. Thus, the miniaturization of the connector can be achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and advantages of the present invention will become more apparent by describing in detail preferred exemplary embodiments thereof with reference to the accompanying drawings, wherein:

Fig. 1 is a perspective view illustrating a connector employing a connector lock structure according to an embodiment of the invention;

Fig. 2 is a longitudinally sectional view illustrating the connector shown in Fig. 1;

Fig. 3 is a longitudinally sectional explanatory view illustrating releasing of the locked condition of the connector shown in Fig. 2;

Fig. 4 is a front view illustrating a lock portion shown in Fig. 1;

Fig. 5 is a perspective view illustrating a related connector lock structure; and

Fig. 6 is a longitudinally sectional view illustrating the connector lock structure shown in Fig. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, a connector lock structure according to an embodiment of the invention is described in detail with reference to the accompanying drawings.

Fig. 1 is a perspective view illustrating a connector employing a connector lock structure according to an embodiment of the invention. Fig. 2 is a longitudinally sectional view illustrating the connector shown in Fig. 1. Fig. 3 is a longitudinally sectional explanatory view illustrating releasing of the locked condition of the connector shown in Fig. 2. Fig. 4 is a front view illustrating a lock portion shown in Fig. 1.

As shown in Figs. 1 and 2, a connector 21 according to this embodiment includes a female connector housing 24, which accommodates and holds a plurality of male terminal metal fittings 23, and also includes a male connector housing 27, which accommodates and holds a plurality of female terminal metal fittings 29.

When the female connector housing 24 and the male connector

housing 27 are fitting-connected to each other, the connector lock structure according to this embodiment locks these connector housings each other by engaging a lock portion 30 provided on an outer (or upper) wall of the male connector housing 27 with an engaging portion 28 provided on an outer (or lower) wall of the female connector housing (or counterpart connector housing) 24.

As shown in Figs. 1 and 2, the lock portion 30 has a flexible lock piece 33, three operating arms 34 and a pair of fulcrum projections 36. The flexible lock piece 33 is frontwardly extended from a front end of a step-like part of the upper wall 31 of the male connector housing 27 along a connector fitting direction (the rightward direction, as viewed in Fig. 2) and has an engaging portion 33a that is engaged with a latch portion 28 of the female connector housing 24 and provided at an end portion thereof. The three operating arms 34 upwardly protrudes from the end portion of the flexible lock piece 33 and rearwardly extends and has a pushing operation portion 34a provided at a rear end portion thereof. Each of the pair of fulcrum projections 36 is provided in such a way as to project toward an outer wall surface 31a of the male connector housing 27 from the bottom surface of a middle part of each of the operating arms 34 facing the outer wall surface 31a.

Moreover, as shown in Figs. 1 and 4, in the case of this embodiment, a flat-plate-like presser piece 41 on a place close to a rear end of each of both the outer side faces of a set of the operating arms 43 in such a way as to horizontally project therefrom. Rise preventing members 43 to be engaged with the presser pieces 41 are provided on both the outer wall surface 31a of the male connector housing 27 so as to prevent a rising of the operating arms

34.

As shown in Fig. 4, each of the rise preventing members 43 includes a support wall 43a, which upwardly protrudes from the outer wall surface 31a of the upper wall 31, and a presser portion 43b protruding upwardly from the top of this support wall 43a and extending nearly horizontally above an associated one of the presser pieces 41. The rise preventing member 43 regulates the rising of the operating arms 34 thereby to prevent the flexible lock piece 33 from upwardly being bending-deformed.

Next, an operation of the lock structure of such a configuration is described hereinbelow.

When the female connector housing 24 and the male connector housing 27 are connected to each other, the engaging portion 33a provided at an end portion of the flexible lock piece 33 is upwardly pushed by the latch portion 28 of the female connector housing 24.

Consequently, the flexible lock piece 33 is upwardly bending-deformed, so that the engaging portion 33a climbs over and engages with the latch portion 28. Thus, the connected condition of the connector housings of the connector 21 is locked.

In a case where the connector housings of the connector 21 are disconnected from each other by releasing the locked condition of the engaging portion 33a of the flexible lock piece 33 and the latch portion 28 of the female connector housing 24, the pushing operation portion 34a provided at the rear end portion of each of the operating arms 34 is depressed in the direction of an arrow C.

Then, the fulcrum projections 36 disposed on the bottom of a set of

the operating arms 34 abut against the outer wall surface 31a of the upper wall 31. The operating arms 34 pivotally swing around the fulcrum projections 36, so that the end of each of the operating arms 34 upwardly moves (in the direction of the arrow C).

5 When the end of each of the operating arms 34 upwardly moves, an upward force acts upon an end portion of the flexible lock piece 33 to which the end portions of the operating arms 34 are connected. Thus, the end portions of the flexible lock piece 33 are upwardly bending-deformed. Consequently, the engaging portion 33a provided at the end portion of the flexible lock piece
10 33 disengages from the latch portion 28 of the female connector housing 24.

 When the engaging portion 33a is released from the latch portion 28 of the female connector housing 24, the operating arms 34 pivotally swing around the fulcrum projections 36. Moreover, when the engaging portion 33a engages with and disengages from the latch portion 28 of the female
15 connector housing 24, the entire flexible lock piece 33 is bending-deformed like a cantilever, an end of which is a free end. Thus, there are no leg portions like those 3a and 5a, at which stress concentration is apt to occur, in the related lock structure.

 The lock portion 30 can prevent occurrences of permanent deflection
20 resulted from fatigue due to stress concentration. Consequently, the lock structure can obtain excellent durability that enables the connector to maintain a stable engaging strength over a long time.

 Moreover, the flexible lock piece 33 is frontwardly extended from the front end of the step-like part of the upper wall 31 of the male connector
25 housing 27 along the connector fitting direction. Thus, the lock structure does

not require leg portions that upwardly protrude from the outer wall surface 31a of the connector housing 27. Consequently, the connector can be designed so that the position, at which the engaging portion 33a of the flexible lock piece 33 is provided, can be adjusted to the position of the upper wall 31 of the male connector housing 27.

The lock structure can suppress the flexible lock piece 33 and the operating arms 34 from protruding upwardly from the outer wall surface 31a of the male connector housing 27. Consequently, the lock structure according to the invention can prevent the outside dimension of the male connector housing 27 from increasing owing to the protrusion of the flexible lock piece 33 and the operating arms 34. Thus, the miniaturization of the connector 21 can be achieved.

Further, the rise preventing members 43 engaged with the presser pieces 41 of a set of the operating arms 34 for preventing the rise of the operating arms 34 are provided on the outer wall surface 31a of the male connector housing 27 in the lock portion 30 of this embodiment.

Thus, even when, for example, a bite-in of foreign matters to the lock portion 30 occurs and an external force is applied thereto in a direction in which an end portion of the flexible lock piece 33 is lifted, during a state in which the female connector housing 24 and the male connector housing 27 are locked, the rise preventing members 43 engage with the presser pieces 41 of a set of the operating arms 34, so that the flexible lock piece 33 can be prevented from being upwardly bending-deformed.

That is, the flexible lock piece 33 is prevented from being improperly upwardly (that is, in a direction in which the locked condition is canceled)

bending-deformed. Thus, an undesirable releasing of the locked condition of the connector housings can be prevented. Connectors can be prevented from being broken due to excessive deformation thereof. Consequently, the lock portion 30 can enhance reliability of the lock.

5 Incidentally, the configurations of the connector housing, the counterpart connector housing, the flexible lock piece, the operating arms and the fulcrum projections according to the connector lock structure of the invention are not limited to those of the embodiment. Needless to say, such constituent elements may have various configurations without departing from
10 the spirit of the invention.

 For example, although the fulcrum projections 36 are provided on the bottom surface of the operating arms 34 in the embodiment, the fulcrum projections may be provided on the outer wall surface 31a of the male connector housing 27, which faces the bottom surface of the set of the
15 operating arms 43, in such a way as to project therefrom. It is sufficient that the fulcrum projections 36 are provided on at least one of the outer wall surface 31a of the male connector housing 27 and the bottom surface of the operating arms 43, which face each other.